

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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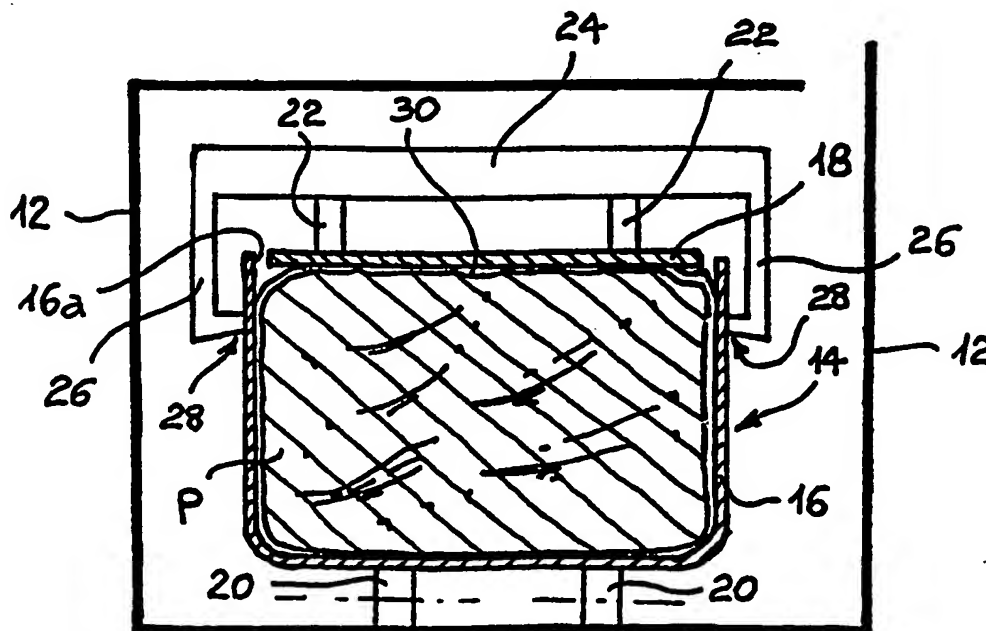
Published

With international search report.

(54) Title: INDUSTRIAL APPARATUS TO HEAT FOODSTUFFS, PARTICULARLY MEAT-PRODUCTS, BY MEANS OF A RADIO FREQUENCY OSCILLATING ELECTROMAGNETIC FIELD

## (57) Abstract

An industrial apparatus to heat foodstuffs, particularly meat-products, including a generator of voltage oscillating at a predetermined radio frequency and an application system to generate an electromagnetic field oscillating at a predetermined radio frequency. The electromagnetic field includes electric and magnetic components which combine, both involving a food product, also a large-size one, to heat at a uniform temperature the entire mass of the food product (P) itself. The application system includes a first application device (12) connected with the generator of oscillating voltage and having the shape of a tunnel.



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INDUSTRIAL APPARATUS TO HEAT FOODSTUFFS, PARTICULARLY MEAT-  
PRODUCTS, BY MEANS OF A RADIO FREQUENCY OSCILLATING  
ELECTROMAGNETIC FIELD

This invention relates to an industrial apparatus to heat foodstuffs, particularly meat-products, by means of a radio frequency oscillating electromagnetic field. This invention particularly, but not exclusively, concerns an apparatus to heat, and as a particular case of heating, to cook, meat-products having considerable mass and volume, preferably placed into moulds, such as baked ham and alike.

Well-known radio frequency heating apparatus include an electric generator which produces a voltage oscillating at a predetermined frequency, typically established by international rules and equivalent to 6.78 - 13.56 - 27.12 or 40.68 MHz, and a capacitive or inductive application device transforming the oscillating voltage in an oscillating electric or magnetic field, respectively.

If the food products have a substantially dielectric behaviour, capacitive application devices are normally used which generate an oscillating electric field involving the food product. The dielectric loss within the product causes the heating thereof. On the contrary, if the food products substantially have a conductive behaviour, inductive application devices are normally used which generate an oscillating magnetic field involving the food product. The electric currents so induced to the conductive product cause the heating thereof.

Tests have been made on meat-products, such as hams, mainly made of meat, fats and salts. This combination of substances behaves in a way which is neither fully dielectric nor fully inductive. Particularly, it has been noted that if an electric field oscillating at 27.12 MHz is applied to a ham having a considerable mass, the electric field hardly penetrates the food product, thus heating quickly enough a layer which is about 2-3 cm thick, while the internal part of the products can not be heated satisfactorily. For this

reason, the well-known apparatus operating according to the principle of the dielectric loss can effectively cook meat-products only when the mass and volume of said products are relatively small.

Another problem affecting the above-mentioned known apparatus is that the distance between the frame of the capacitive application device and the meat-products must be as little as possible. For this reason such apparatus are almost exclusively used to cook products having predetermined geometric shapes, usually a tubular shape.

Cooking tests have been made on meat-products having a considerable mass also by using apparatus having inductive application devices. In this case, it has been found that the products can be heated more quickly than by using the dielectric loss system but, however, it does not ensure a total penetration of the field into the mass of the meat-product because of the imperfect, incomplete and non-homogeneous conductive behaviour of the product.

This invention has the purpose to solve the problems encountered when cooking and/or heating by radio frequency meat-products by means of the well-known apparatus.

Another purpose of this invention is to provide an apparatus which may be easily and economically manufactured, used and maintained, and which may be used also in the case that foodstuffs must be placed into moulds having various shapes.

In order to achieve the above purposes, the invention concerns an apparatus having the characteristics claimed in the following claim 1.

The invention also concerns a container which is particularly proper to cook and/or heat meat-products in an apparatus as mentioned above.

An advantage of this invention is that the apparatus may be easily integrated within an industrial system to cook foodstuffs, particularly a system of continuous cooking. Furthermore, when this invention is applied to the cooking of

hams, one of the advantages is the considerable reduction of the cooking time if compared to the traditional methods of steam-cooking and, more particularly, a reduction equivalent to at least 80%.

Further characteristics and advantages of this invention will be shown by the following detailed description of a preferred embodiment, with reference to the drawings which shall be considered as a non-restrictive example, in which:

Fig. 1 is a schematic perspective view of a tunnel-shaped application device used in the apparatus according to this invention, and

Fig. 2 is a cross-sectional view of the tunnel-shaped application device of Fig. 1, in which a container carrying a meat-product to be cooked is inserted.

Now, referring to the drawings, an apparatus to heat a meat-product P includes a generally known electric generator 10 which produces, at its ends, a voltage oscillating at a pre-determined frequency, which international rules on radio frequency allow to choose among 6.78 - 13.56 - 27.12 or 40.68 MHz. The voltage produced by the electric generator 10 is supplied to a metal tunnel-shaped inductive application device 12 within which an oscillating magnetic field is consequently produced.

As it may be seen from Fig. 2, a container or mould 14, which includes a tray 16 and a cover 18, both made of metal, may be placed into the tunnel-shaped application device 12. The cover 18 is slightly smaller than the lead-in edge 16a of the tray 16 so that, once the container is closed, an insulating continuous hollow space is formed. Alternatively or additionally, a seal or seam made of insulating material may be placed between the cover 18 and the tray 16.

The container 14 may be moved along the tunnel 12 on conveyor means such as rollers or wheels 20. Alternatively, the container may be placed on a conveyor belt or similar device placed within the tunnel and which is movable from one end to the other of the same. According to two alternative

embodiments of the invention, the conveyor means 20 may be made of conductive material or insulating material, for the reasons which will become more evident below. The meat-product P is placed into the container 14 and is pressed from the above by the cover 18 by means of pressure members 22, which may be rigid or elastic, connected to a C-shaped transversal bar coupled to the opposed sides of the trays 16. The meat-product P is sometimes enclosed in a sealed packaging 30.

The cover 18, the pressure members 22 and the transversal bar 24, including side couplings 26, constitute a whole conductive assembly and the side couplings 26 are also in electric connection with the tray 16, even if only in the two areas 28 having a thinner section.

In order to uniformly heat all the mass of the product P, the latter is placed into the container 14, closed by the cover 18 which is coupled to the sides of the tray 16 by means of the couplings 26 of the C-shaped transversal bar 24. The container is then inserted through one of the ends of the tunnel 12 and placed on conveyor means 20 which gradually shift the container toward the opposed end of the tunnel 12. During such shifting, the generator 10 is operated so that a magnetic field is generated within the tunnel 12.

In a first embodiment, the conveyor means 20 insulate the container from the metal surface of the tunnel. By this way, the metal system constituted by the container and the transversal bar 24 behaves like a metal coil involved by a magnetic field and, therefore, is crossed by currents which, on their turn, generate a magnetic field involving the meat-product P. Furthermore, because of the shape of the cover and of the tray, a difference of potential is generated between said two elements thus producing, within the container, also an electric field involving the meat-product P.

Therefore, the meat-product is exposed to the combined action of the oscillating electric and magnetic fields which cause the same to heat, not only superficially but also

deeply. The action of the magnetic field prevails on the action of the electric field when the product P, at a certain stage of its cooking, behaves as a conductor, while the contrary happens at those stages of its cooking during which the product behaves as dielectric. In order to avoid that an electric contact between the cover 18 and the lead-in edge 16a of the tray 16 nullifies the capacitive effect and therefore the electric field involving the meat-product P, it is important that a continuous hollow space formed by air or an insulating material is always present between the cover 18 and the tray 16.

In the alternative embodiment of the invention, in which the container 14 is electrically connected with the tunnel 12 by means of the conductive conveyor means 20, the oscillating magnetic field involving the meat-product is directly generated by the container 14 which becomes an extension of the application device 12. In a way which is absolutely similar to the above, the flow of currents within the container and the bar 24 causes a difference of potential between the tray 16 and the cover 18 thus generating an oscillating electric field involving the product P.

By means of an apparatus like the one described above as a non-restrictive example, it is possible to reduce to one fifth the time necessary to heat and/or cook the meat-product P in comparison to the traditional techniques of steam-cooking. Furthermore, it is possible to use containers or moulds which are very similar, if not identical, to those used for traditionally cooking meat-products, particularly for the production of baked hams.

Clearly, without prejudice to the principle of the invention, the embodiments and the details of implementation may be widely changed without drawing away from the scope of this invention.

CLAIMS

1. Industrial apparatus to heat food products, particularly meat-products, including a generator of voltage oscillating at a predetermined radio frequency, characterised in that it includes an application device to generate an electromagnetic field oscillating at the predetermined frequency, the electromagnetic field including electric and magnetic components which combine, both involving a food product, also a large-size one, to heat at a uniform temperature the entire mass thereof.
2. Industrial apparatus according to claim 1, characterised in that the application system includes a first application device connected with the generator of oscillating voltage, a second application device in combination with the first including at least two opposed portions between which, during the operation, a food product is placed and a difference of potential is generated to expose the food product to an electric field, the second application device being crossed by radio frequency electric currents inducing an oscillating magnetic field which is superimposed to the electric field and involves the food product.
3. Industrial apparatus according to claim 2, characterised in that the first application device is an inductive application device which generates a radio frequency oscillating magnetic field, the second application device being electrically insulated by the first application device, the oscillating magnetic field generated by the first application device involving, during the operation, the second application device to generate within the latter a flow of electric currents and the difference of potential.
4. Industrial apparatus to heat food products, namely meat-products, including a generator of voltage oscillating at a predetermined radio frequency, and an inductive application device to transform the oscillating voltage generated by the generator into a magnetic field, characterised in that it further includes conveyor means to insert and extract food



products into and from the tunnel-shaped application device.

5. Apparatus according to claim 4, characterised in that the conveyor means continually insert and extract food products into and from, respectively, opposed ends of the tunnel-shaped inductive application device.

6. Apparatus according to claim 4, characterised in that the food products are contained within containers including a tray and a cover.

7. Apparatus according to claim 6, characterised in that the containers are made of a conductive material, the cover being electrically connected with the tray through a conductive portion having a thinner section.

8. Apparatus according to claim 7, characterised in that the tray is electrically connected with the tunnel-shaped inductive application device.

9. Apparatus according to claim 7, characterised in that the container is electrically insulated from the tunnel-shaped inductive application device.

10. Apparatus according to claims 5 and 8, characterised in that the conveyor means include members which support and drag the containers, electrically connected with the tunnel-shaped application device and the containers.

11. Apparatus according to claims 5 and 9, characterised in that the conveyor means include members which support and drag the containers and which electrically insulate said containers from the tunnel-shaped inductive application device.

12. Apparatus according to claim 4, characterised in that it further includes a second application device combined with the inductive application device, which generates an electromagnetic field having electric and magnetic components which combine to heat at a uniform temperature the entire mass of a food-product.

13. Apparatus according to claims 6 and 12, characterised in that the food product containers act as a second application device.

14. Container to cook food products within an industrial apparatus according to claim 1, characterised in that it includes a tray having a lead-in edge and a cover which, when the container is closed, is insulated from the lead-in edge of the tray by an electrically insulating hollow space, and a closing member having a thinner section electrically connecting the cover and the tray, the container, which during the operation is involved by an external radio frequency oscillating electromagnetic field, being proper to generate, within itself, an electromagnetic field including electric and magnetic components which combine to heat at a uniform temperature the entire mass of a food product placed into the container.

15. Container according to claim 14, characterised in that the closing member includes pressure members to press the cover against the food product placed, during the operation, within the tray.

Fig. 1

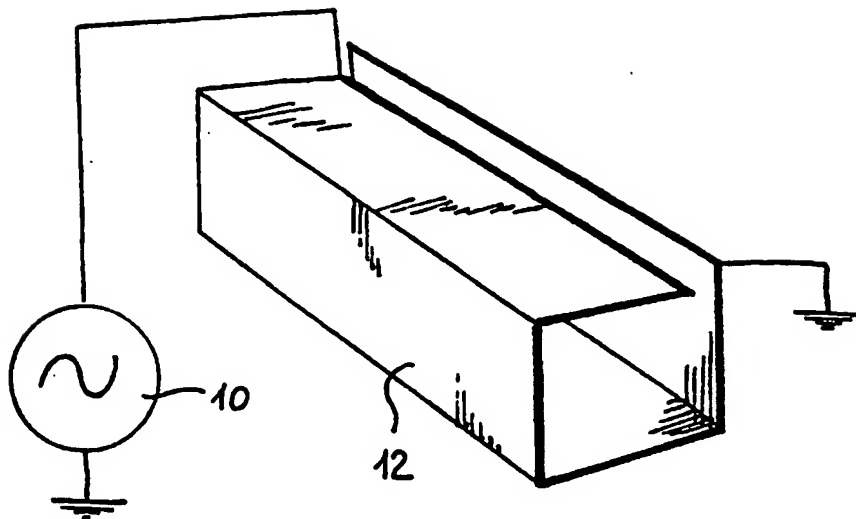
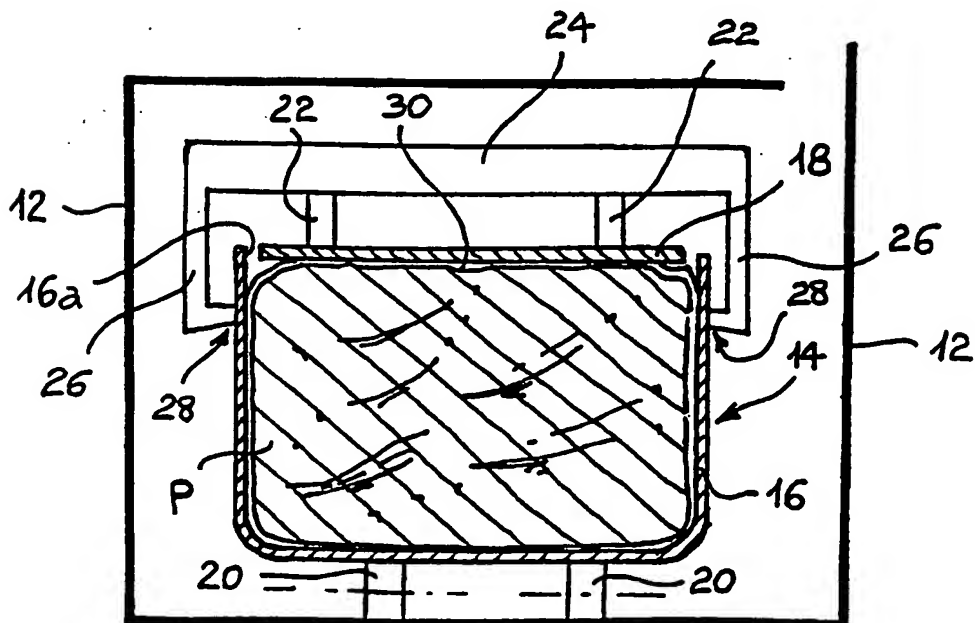


Fig. 2



# INTERNATIONAL SEARCH REPORT

In tional Application No

PCT/IT 97/00316

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A23B4/01 23/01 H05B6/80

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A23B A23L H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 88 02222 A (TULIP SLAGTERIERNE A.M.B.A.) 7 April 1988 see page 6; figure	1,2
X	EP 0 278 592 A (K. KICHLU) 17 August 1988 see claims 13,14	1,4,5
A	GB 835 984 A (ZWANWENBERG'S FABRIEKEN N.V.) 1 June 1960 see the whole document	1-13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

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Date of the actual completion of the international search

3 April 1998

Date of mailing of the international search report

15/04/1998

Name and mailing address of the ISA

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Authorized officer

Lepretre, F

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 97/00316

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		DK 693687 A	14-07-88
		FI 880040 A	14-07-88
		JP 63214163 A	06-09-88
GB 835984 A		NONE	

**Hardee, Ryan T.**

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**From:** English, D. Joseph  
**Sent:** Friday, August 26, 2005 12:00 PM  
**To:** 'Paul Juergensen'  
**Cc:** Rogers, L. Lawton; Hardee, Ryan T.  
**Subject:** FW: Honeywell v. Audiovox

**Attachments:** order setting teleconference 8-26.pdf

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**From:** Neiderman, Matt  
**Sent:** Friday, August 26, 2005 11:11 AM  
**To:** Rogers, L. Lawton; English, D. Joseph  
**Subject:** Honeywell v. Audiovox

FYI



order setting  
teleconference 8...

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL INC., and )  
HONEYWELL INTELLECTUAL PROPERTIES )  
INC., )

Plaintiffs, )

v. )

AUDIOVOX COMMUNICATIONS CORP., )  
AUDIOVOX ELECTRONICS CORPORATION, )  
NIKON CORPORATION, NIKON, INC., NOKIA )  
CORPORATION; NOKIA INC., SANYO )  
ELECTRIC CO., LTD., and SANYO NORTH )  
AMERICA CORPORATION, )

Defendants. )

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HONEYWELL INTERNATIONAL INC., and )  
HONEYWELL INTELLECTUAL PROPERTIES )  
INC., )

Plaintiffs, )

v. )

APPLE COMPUTER, INC.; ARGUS A/K/A )  
HARTFORD COMPUTER GROUP, INC.; )  
CASIO COMPUTER CO., LTD.; CASIO, INC.; )  
CONCORD CAMERAS; DELL INC.; EASTMAN )  
KODAK COMPANY; FUJI PHOTO FILM CO., )  
LTD.; FUJI PHOTO FILM U.S.A., INC.; )  
FUJITSU LIMITED; FUJITSU AMERICA, INC.; )  
FUJITSU COMPUTER PRODUCTS OF )  
AMERICA, INC.; KYOCERA WIRELESS )  
CORP.; MATSUSHITA ELECTRICAL )  
INDUSTRIAL CO.; MATSUSHITA )  
ELECTRICAL CORPORATION OF AMERICA; )  
NAVMAN NZ LIMITED; NAVMAN U.S.A. INC.; )  
OLYMPUS CORPORATION; OLYMPUS )

Civil Action No. 04-1337-KAJ  
(Consolidated)

Civil Action No. 04-1338-KAJ

AMERICA, INC.; PENTAX CORPORATION; )  
PENTAX U.S.A., INC.; SONY CORPORATION; )  
SONY CORPORATION OF AMERICA; SONY )  
ERICSSON MOBILE COMMUNICATIONS AB; )  
SONY ERICSSON MOBILE )  
COMMUNICATIONS (USA) INC.; TOSHIBA )  
CORPORATION; and TOSHIBA AMERICA, )  
INC., )

Defendants. )

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OPTREX AMERICA, INC., )

Plaintiff, )

v. )

Civil Action No. 04-1536-KAJ

HONEYWELL INTERNATIONAL INC., and )  
HONEYWELL INTELLECTUAL PROPERTIES )  
INC., )

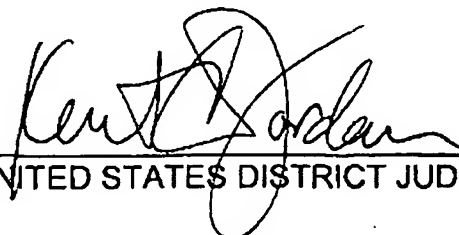
Defendants. )

**ORDER**

At Wilmington this 26th day of August, 2003,

IT IS ORDERED that a status teleconference has been scheduled for  
**September 9, 2005 at 10:30 a.m. with the undersigned. Counsel for Honeywell  
International, Inc. shall initiate the teleconference call.**

If there are out-of-state counsel working on this case, local counsel are  
reminded of their obligation to inform their out-of-state co-counsel of this Order.

  
UNITED STATES DISTRICT JUDGE



